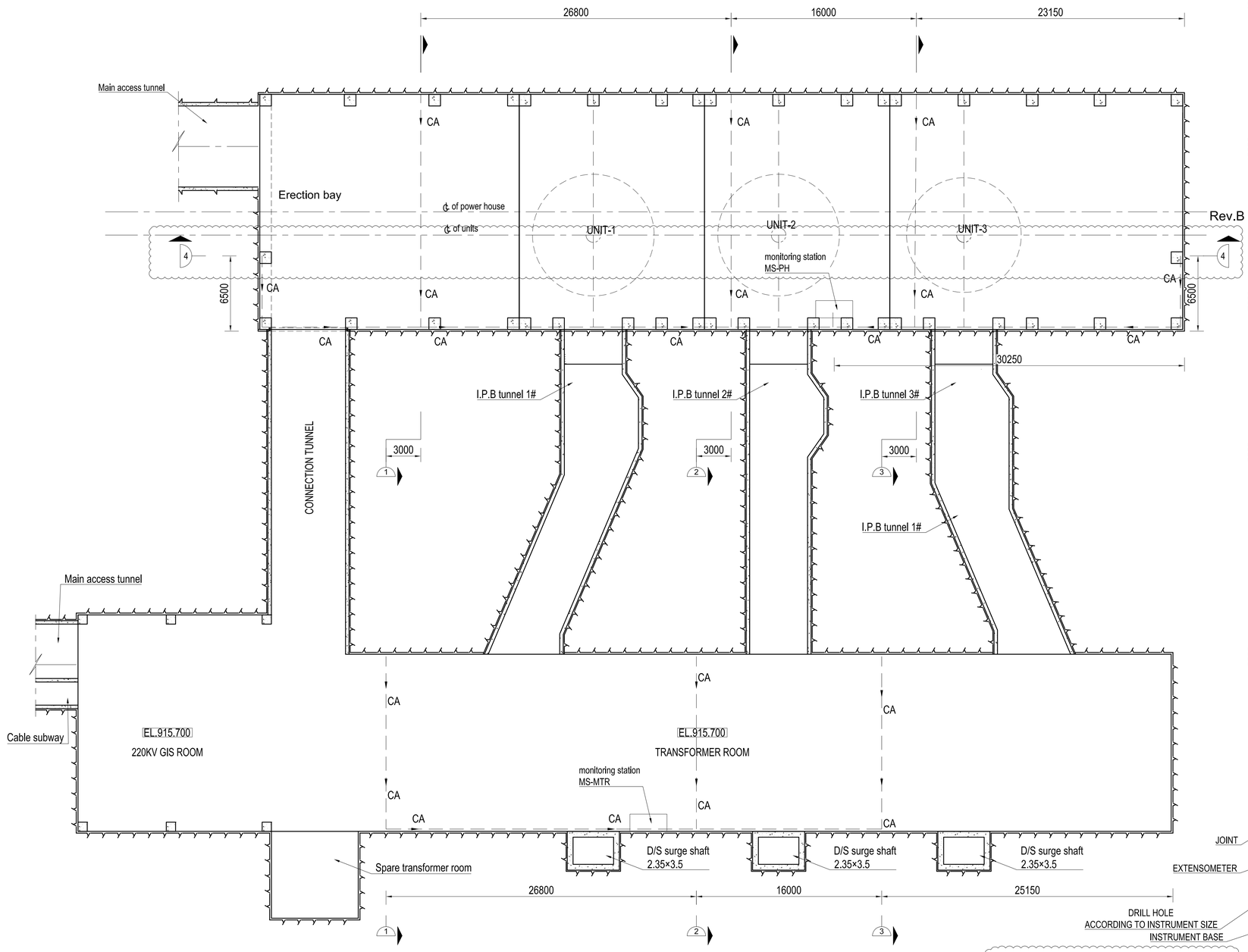
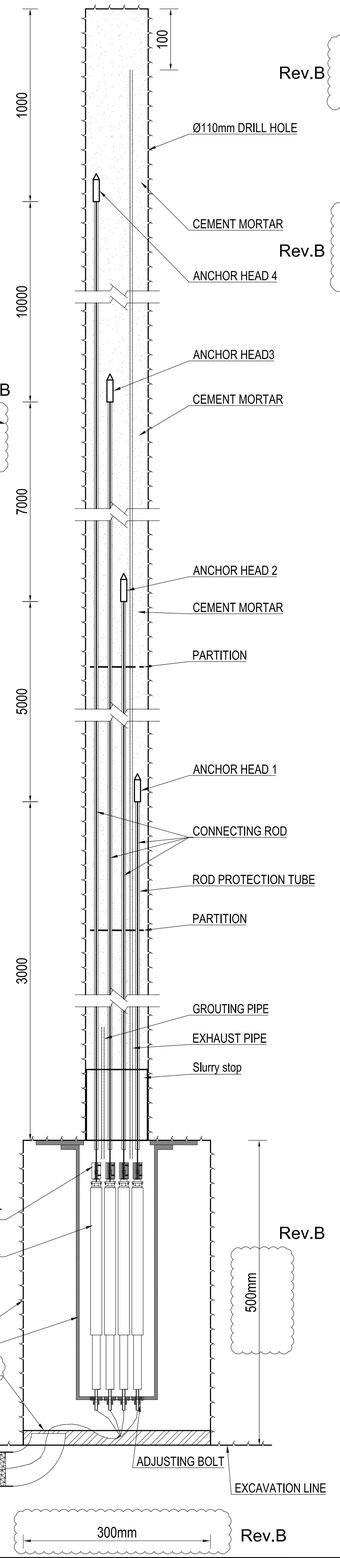
MONITORING LAYOUT DRAWING OF UNDERGROUND POWERHOUSE AND TRANSFORMER CAVERN

SCALE:1:200



SCHEMATIC DIAGRAM OF MULTI-POINT EXTENSOMETER



NOTE

1. All dimensions are in millimeters, and coordinates, chainage and elevation are in meters unless otherwise stated in the drawing.
2. Layout of Underground powerhouse and Transformer cavern is subject to the drawing UT1-C-300-CVL-DG-60001.
3. All monitoring instruments should be installed as early as possible and must be installed before the side drifts in the crown section are opened.
4. Besides deep deformation & convergence measurement, other monitoring items can be carried out as per actual conditions and request of Employer or onsite OE during construction.
5. All cables are protected by PVC/rubber pipes embedded in the shotcrete liner.Attention shall be paid to prevent cables from being damaged during construction.
6. The monitoring station of Underground powerhouse and Transformer cavern is arranged at generator floor at EL.915.70m

REFERENCE DRAWINGS

UT1-C-300-CVL-DG-60001	Arrangement Drawing of Underground Powerhouse and Transformer Cavern

SYMBOL AND LEGEND

FOR APPROVAL

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0A	30.MAY.2022	FIRST ISSUE	CUI J.W.	YUAN Q.S.	LI W.G. CHEN S.L.

PROJECT TITLE

Upper Trishuli-1 HEP (216MW)

OWNER

NWEDC NEPAL WATER AND ENERGY DEVELOPMENT CO. PVT.LTD.

OWNER'S ENGINEER

TRACTEBEL ENGIE jade CONSULT

CONTRACTOR

DOOSAN Enerbility

DRAWING TITLE

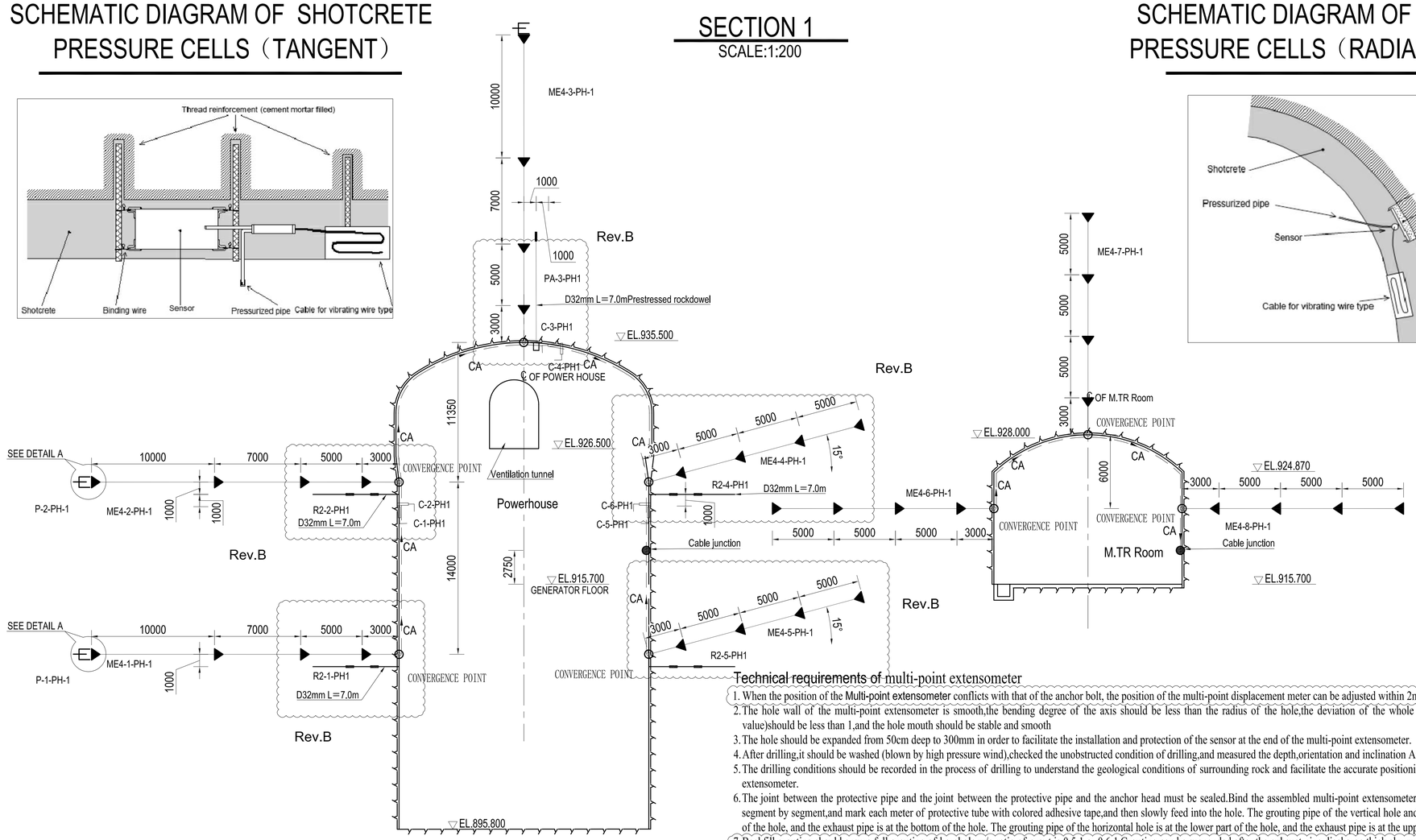
Monitoring Layout Drawing of Underground Powerhouse and Transformer Cavern

INDEX	DRAWING NUMBER	SHEET NO.	REV. NO.
A	UT1-C-845-CVL-DG-70002- 1	1 OF 4	0B

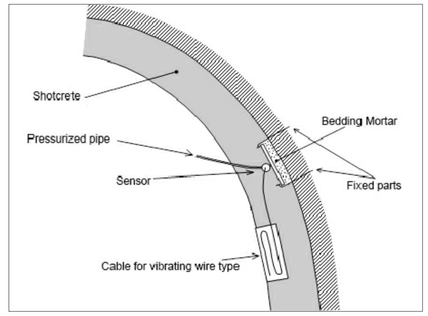
A1 (594 x 841 MM)

SCHEMATIC DIAGRAM OF SHOTCRETE PRESSURE CELLS（TANGENT）

SECTION 1
SCALE:1:200



SCHEMATIC DIAGRAM OF SHOTCRETE PRESSURE CELLS（RADIAL DIRECTION）



Technical requirements of multi-point extensometer

Rev.B

1. When the position of the Multi-point extensometer conflicts with that of the anchor bolt, the position of the multi-point displacement meter can be adjusted within 2m.
2. The hole wall of the multi-point extensometer is smooth,the bending degree of the axis should be less than the radius of the hole,the deviation of the whole hole (compared with the design value)should be less than 1,and the hole mouth should be stable and smooth
3. The hole should be expanded from 50cm deep to 300mm in order to facilitate the installation and protection of the sensor at the end of the multi-point extensometer.
4. After drilling,it should be washed (blown by high pressure wind),checked the unobstructed condition of drilling,and measured the depth,orientation and inclination Angle of drilling.
5. The drilling conditions should be recorded in the process of drilling to understand the geological conditions of surrounding rock and facilitate the accurate positioning of anchor head of multi-point extensometer.
6. The joint between the protective pipe and the joint between the protective pipe and the anchor head must be sealed.Bind the assembled multi-point extensometer,grouting pipe and exhaust pipe segment by segment,and mark each meter of protective tube with colored adhesive tape,and then slowly feed into the hole. The grouting pipe of the vertical hole and the upward hole is at the mouth of the hole, and the exhaust pipe is at the bottom of the hole. The grouting pipe of the horizontal hole is at the lower part of the hole, and the exhaust pipe is at the upper part of the hole.
7. Backfill grouting should ensure full grouting of borehole.w/c-ratio of grout is 0.5:1 or 0.6:1.Grouting can be suspended after the exhaust pipe discharge thick slurry.Grouting can be done again after 15 minutes,and the grouting pipe will be tied to close the grouting after the exhaust pipe has discharged the thick slurry again.
8. To confirm functionality of extensometer, a reading shall be performed directly after grout setting,24 hours after the final grout setting.fix the sensor device,draw out the cable,install the protective cover and hole protection cover,and obtain the initial reading.
9. After installation,spray the instrument number on the steel cap\ concrete or rock near the measuring point with red paint.

Rev.B

OBSERVATION INSTRUMENT EQUIPMENT LIST

NO.	NAME	LEGEND	SYMBOL	QUANTITY	UNIT	REMARK
1	Multi-point extensometer		ME4	23	set	Vibrating wire displacement transducer,Range 100mm,Resolution0.025%F.S..Including sensor, connecting rod, rod protection tube, anchor head, partition plate, instrument base and other orifice devices.
2	Hole for Multi-point extensometer			530	m	Borehole diameter Ø110mm, single hole depth 26m or 19m,including backfill grouting.The hole for installing the piezometer at the bottom of the hole is 27m deep.
3	10 cores cable for vibrating wire type		CA	1580	m	10 core, galvanized copper wire.For multi-point extensometer,Anchor dynamometer.
4	Piezometer		P	9	pieces	Vibrating wire instrument,Range 1PMa,Resolution0.025%F.S..
5	4 cores cable for vibrating wire type		CA	3300	m	4 core, galvanized copper wire.For piezometer, anchor bar stress meter,Shotcrete pressure cell.
6	Anchor dynamometer		PA	3	set	Vibrating wire instrument,Range 400kN,Resolution0.03%F.S..,3wires.
7	Two-points anchor bar stress meter		R2	10	set	Vibrating wire instrument,Range 400MPa,Resolution0.05%F.S..Each set of instruments includes two sensors.
8	Shotcrete pressure cell		C	18	set	Vibrating wire instrument,Resolution0.04%F.S..Range :radial direction:7MPa;tangent:20MPa.
9	Convergent measuring point				set	The number of measuring points shall be calculated according to the monitoring section
10	Hub box		B	7	set	Allow access to 20 instruments,Protect with a homemade protective box.
11	Cable protection tube			530	m	50mm-100mm diameter,thick and flexible PVC/rubber pipes.

Rev.B

NOTE

1. All dimensions are in millimeters, and coordinates, chainage and elevation are in meters unless otherwise stated in the drawing.
2. Other see sheet 1.

REFERENCE DRAWINGS

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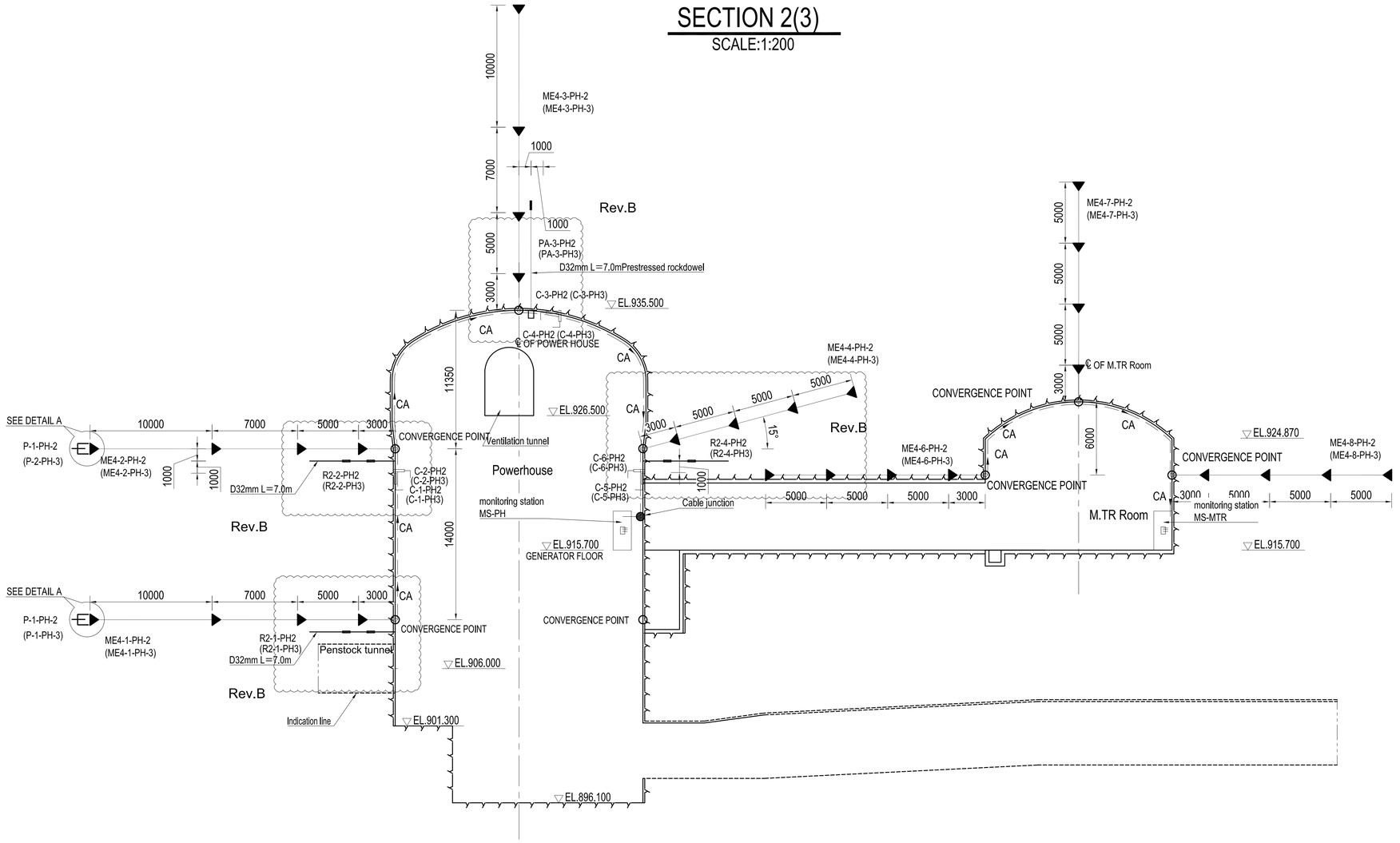
INDEX	DRAWING NUMBER	SHEET NO.	REV. NO.
A	UT1-C-845-CVL-DG-70002- 2	2 OF 4	0B

A1 (594 x 841 MM)

SECTION 2(3)

SCALE:1:200



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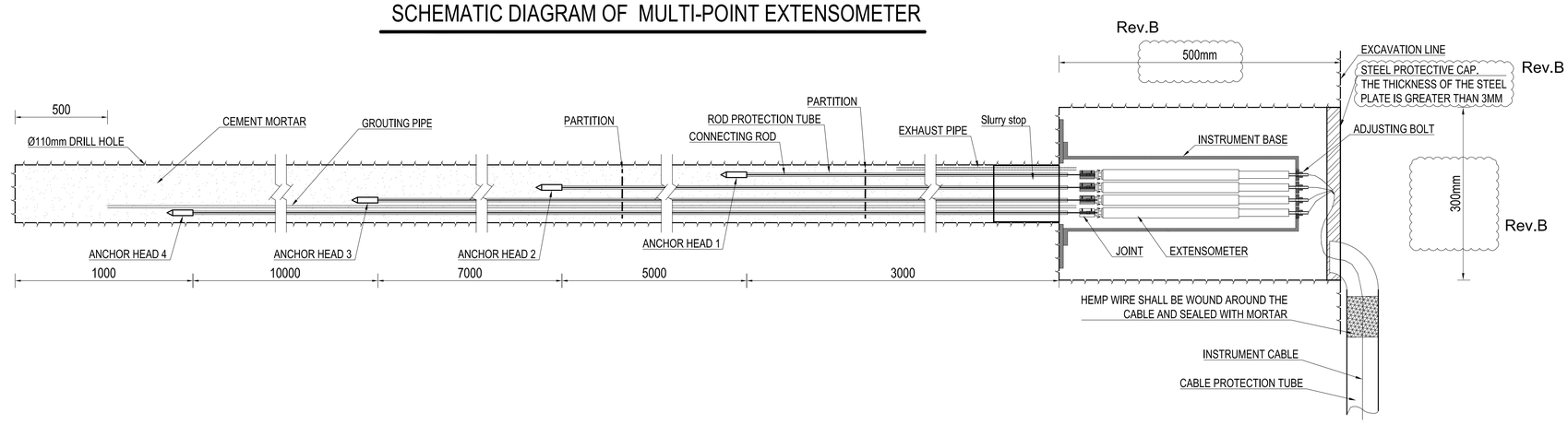

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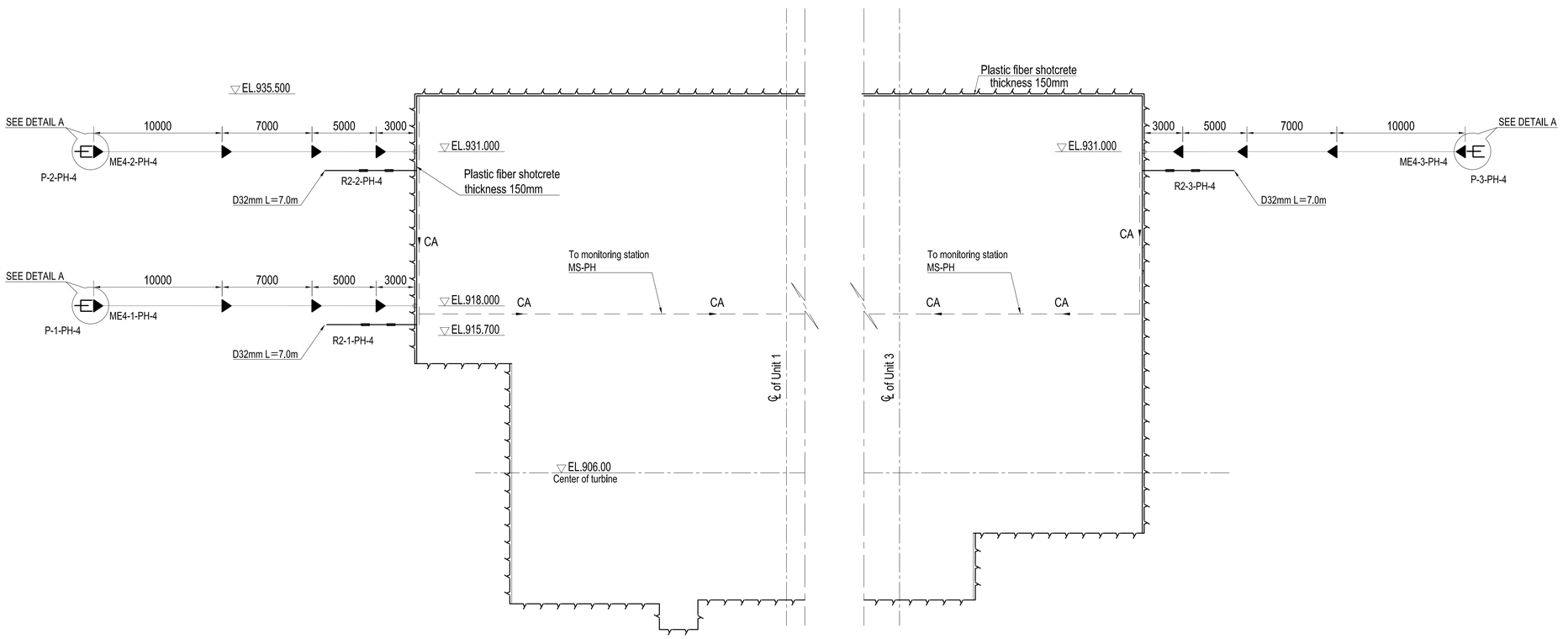
A1 (594 x 841 MM)

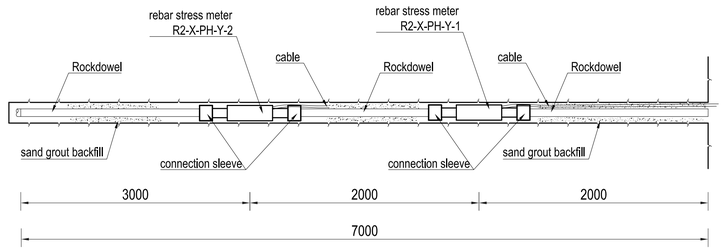
SECTION 4-4

SCALE:1:200

Rev.B

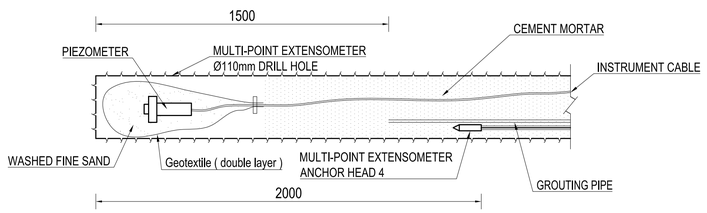


SCHEMATIC DIAGRAM OF VIBRATING WIRE REBAR STRESS METER

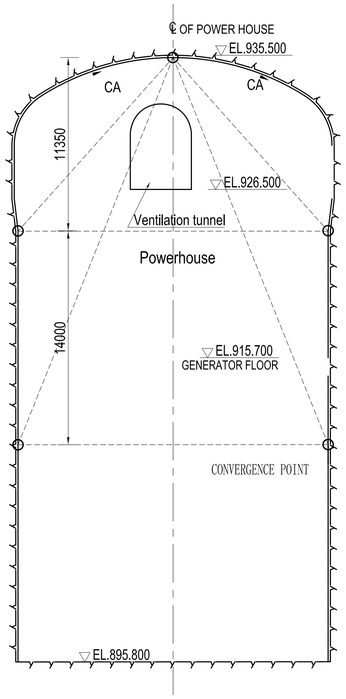


SCHEMATIC DIAGRAM OF VIBRATING WIRE REBAR STRESS METER

DETAIL A

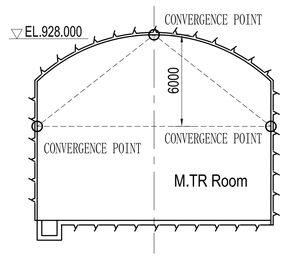


TYPICAL SECTION OF MEASUREMENT POINTS ARRANGEMENT



Technical requirements of surrounding rock deformation monitoring

1. Monitoring method: convergence monitoring adopting total station, monitoring points affixed with reflector.The reflector is self-adhesive and can also be fixed with rebar.Monitoring accuracy/error limit: 1mm.
   Monitoring sections setting: It coincides with the monitoring sections 1, 2 and 3 in Drawing 1.
   For portal tunnel section, shallow buried section, soft weak stratum or tunnel section with poor geological conditions, the monitoring sections shall be properly increased as per onsite OE.
2. Measuring frequency:
   (1)The monitoring section shall be set as soon as possible;Points need to be protected from fly-rock.
   (2)The initial/first monitoring shall be carried out immediately after the installation of the instrument and prior to the tunnel face advancing; The surveyor shall be available during installation.



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